SECTION 240.00 – PHASE III PAVEMENT ESTIMATING REPORT

The purpose of the estimating report is to provide the designer with the pavement type, typical sections, materials, and estimating data necessary to compute plan quantities and cost estimates for highway paving projects.

240.01 Pavement Type and Surface Smoothness. Provide a statement as to the pavement type approved. Refer to Section 540.00, Pavement Structure Analysis. Normally the pavement type determination is made when the concept is approved.

For Flexible Pavements, determine the Pavement Smoothness Schedule using the following guidelines:

The Pavement Smoothness Schedule will be determined by project classification based on opportunities for improving the ride, by pre-paving smoothness value or by a combination of both. Each of the following is considered one opportunity to improve the ride:

- Placing a base course
- CRABS or Full Depth Reclamation
- Milling
- Hot or Cold Recycling
- Machine laid leveling course
- Each lift of plant mix surfacing

Schedule I projects include new construction, full depth reclamation, CRABS or projects with one of the following:

- Three or more opportunities for improving the ride,
- A pre-paving IRI less than 140 in/mi (2.21m/km) and two opportunities for improving the ride or,
- A pre-paving IRI less than 90in/mi (1.42m/km) and one opportunity for improving the ride or,
- Other projects as designated.

Schedule II projects are projects with one of the following:

- A pre-paving IRI greater than 140 in/mi (2.21m/km) and two opportunities for improving the ride or
- A pre-paving IRI greater than 90 in/mi (1.42m/km) and less than 140 in/mi (2.21m/km) with one opportunity for improving the ride or,
- Other projects as designated

Projects not meeting the above pre-paving ride guidelines may be designated as Schedule 3 projects. New construction, full depth reclamation and CRABS projects are considered Schedule I projects regardless of pre-paving IRI.

If no Schedule is specified pavement will be subject to straight edge requirements only.

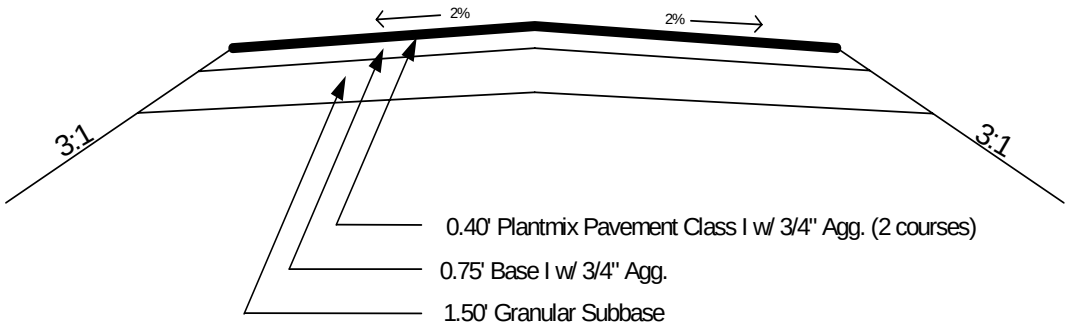
The Pavement Smoothness Schedule will be specified here and on the typical section drawing.

Example:

> Flexible pavement was approved October 25, 1998. Pavement Smoothness Schedule I shall be required.

240.02 Typical Section. Enclose a sketch showing each typical section for the project. Width, depths, and dimensions need not be to scale. Multiple typical sections with labels depicting the layer material and thickness may be used or a single typical section with layer thicknesses displayed in tabular form as shown in the example. The pavement width or lane configuration shown on the typical sections depicted here are not necessarily as shown on the final plans. However, the thicknesses represented on the final plans must be as shown here. Also, identify the Pavement Smoothness Schedule.

Example:



240.03 Base. Show all elements of the base and subbase with appropriate lab report numbers to substantiate the estimating basis. Include asphalt requirements for treated bases, blotter material, tack and prime, fillers, excavation for soft spots, reconditioning, special compaction requirements, or any other item necessary to the designer for estimating purposes. It is desirable to identify possible materials source to be used to determine estimating information for each item.

- Examples:

  Reconditioning

  Reconditioning is required from Station 3301+00 to 3392+10. Water for reconditioning will be 200 MG (750 m^3). Excavation of soft spots is required between Stations 3304+00 and 3389+00. Reconditioning is defined in Subsection 304, Reconditioning in the ITD Standard Specifications.

  Treated Base

  PG 58-28 Binder for Plant Mix Base Course at 6.5% by weight and 1% hydrated lime filler, for estimating purposes only, Source El-53-s, Lab No. 229749 was used.

  MC-250 Liquid Asphalt for Road Mix Base Course at 4.9% by weight, for estimating purposes only, Source El-53-s, Lab No. 85-A0391 was used.

  MC-250 Liquid Asphalt for Curing Seal at 0.25 gal./ s.y. (1.2 L/m^2). Blotter Material at 10 lb./s.y. (5.5 kg/m^2), for estimating purposes only, Source El-53-s was used.

Tack and Prime

MC-250 Liquid Asphalt for Prime at 0.30 gal./s.y. (1.4 L/m²). SS-1 Diluted Emulsion Asphalt for Tack at 0.05 gal./ s.y. (0.2 L/m²). Blotter Material at 10 lb./s.y. (5.5 kg/m²), for estimating purposes only, Source El-53-s was used.

240.04 Surface Treatment. If Surface Treatment is a necessity, contact HQ Materials for guidance. A review of Asphalt Institute literature is advisable. Specify type of surface treatment and aggregate size with type of asphalt and rate of application. Surface Treatments are very rarely used. Except for special circumstances, the specified information will indicate a Surface Treatment is not to be used. For the purposes of this section, a Surface Treatment is not a Seal Coat. Seal Coats are addressed separately in Section 240.06.

- Example:

  Surface Treatment is not used for this Project.

240.05 Paving. List information and estimating data based on an acceptable Job mix formula, showing percent asphalt, additives, and appropriate lab numbers of corresponding reports. For projects with contractor furnished sources, known lab information from probable or nearby sources may be used. If a probable source is not apparent, estimate the percent asphalt and additives typically used in that area. Replace source and lab number with “estimated”.

- Examples:

  PG 70-28 Binder for the Top Course Plant Mix at 6.4% by weight, for estimating purposes only, Source El-53-s, Lab No. 86-A0413 was used.

  PG 64-34 Binder for Plant Mix pavement at 5.4% by weight, estimated.

  PG 58-28 Binder for the Bottom Course Plant Mix at 6.4% by weight, for estimating purposes only, Source El-53-s, Lab No. 85-A0053 was used.

  Concrete Pavement Using Coarse Aggregate Size No. 3 (estimated)

The following guidelines for class of asphaltic plantmix are recommended as the selection criteria for flexible pavement:

Class	*Jurisdiction / Traffic of Route*
I	All Interstate and NHS routes All other routes with Truck ADT $\geq$ 1000 (high volume)
II	All other routes with 250 $\leq$ Truck ADT < 1000 (medium volume)
III	All other routes with Truck ADT < 250 (low volume)

Exceptions to the above minimum criteria should be individually justified.

240.06 Seal. List all data regarding the type of cover coat, asphalt additives, and lab numbers. Give consideration to providing a smooth surface for shoulder / bike lanes.

- Examples:

  CRS-2R Emulsified Asphalt for Seal at 0.25 gal./s.y. (1.2 L/m²), plus 0.5% Anti-Strip Super Concentrate Additive.

  Full width 23 meters (76') for four lanes. Cover Coat Material Class 4 at 25 lb./s.y. (14 kg/m²), for estimating purposes only, Source El-53-s was used.

  Fog Coat (Contingency Item) and Blotter.

  CSS-1H Diluted Emulsion for Fog Coat at 0.08 gal./ s.y. (0.5 L/m²). Blotter Material at 5 lb./s.y. (3 kg/m²) (estimated).

240.07 Aggregate Estimating Data. List the weight in pounds per cubic foot (kilograms per cubic meter) for each size aggregate to be used on the project. Include moisture in the weight. For projects with contractor furnished sources, known lab information from probable or nearby sources may be used. If a probable source is not apparent, estimate the weight typical in that area. Replace source and lab number with “estimated”.

- Examples:

  Size, Estimated Aggregate Compacted lb./c.f. (kg/m³).

  3/4” (19 mm) Aggregate at 140 lb./c.f. (2240 kg/m³) for Base, including 7% water, Lab No. 217186.

  1” (25 mm) Aggregate at 143 lb./c.f. (2300 kg/m³) for Cement-treated Base, including 7% water, Lab No. 218469.

  1/2” (13 mm) Aggregate at 143 lb./c.f. (2300 kg/m³) for Plant Mix Base, including asphalt, Lab No. 219649.

  3/4” (19 mm) Aggregate at 143 lb./c.f. (2300 kg/m³) for Plant Mix Pavement, including asphalt, Lab No. 219650.

  1/2” (13 mm) Aggregate at 143 lb./c.f. (2300 kg/m³) for Road Mix Pavement (dry weight aggregate), (estimated).

  Blotter Material at 125 lb./c.f. (2000 kg/m³), Source El-53-s.

  Cover Coat Material at 87 lb./c.f. (1400 kg/m³), Source El-53-s.

240.08 Aggregate Sources. Include the following information on each aggregate source. When contractor furnished sources are used, the following table does not apply.

- Example:

Source No.	Quantity Proved c.y. (m^3)	Estimated Quantity Required c.y. (m^3)	Estimated Quantity of Sanding Material ton (metric ton)	Overburden to be Stripped c.y. (m^3)	Authority for use Expiration Date	Archeological Clearance Date
El-53-s	150,000 (115 000)	120,000 (92 000)	5,000 (4500)	10,000 (7700)	9/1/75	No Record

- Example:

  Approved Contractor Furnished Sources shall be used for all aggregates.

SECTION 250.00 – PHASE IV FOUNDATION INVESTIGATION REPORT

The purpose of the foundation investigation report is to provide structural designers and construction personnel with specific information regarding the subsurface conditions at a structure site and detailed geotechnical recommendations for use in design and construction. Structures requiring foundation investigations include bridges, buildings, cast-in-place and tied back retaining walls, bin or crib walls, gabion walls, and mechanically stabilized earth (MSE) walls, or supporting structures over ten feet (three meters) high.

Most pipe installations under fills, including foundation considerations, are handled in the Phase II Soils Report. Arches, concrete box culverts, “superspans,” machine passes, half pipes with footings, and other pipe structures which are used in lieu of bridges will typically require a Phase IV report.

Buildings that are larger than 550 sq.ft (50 square meters) will typically require a Phase IV report.

Traffic signal poles, lighting poles are normally constructed with standard foundations as shown in Standard Drawing I-7-C and therefore do not require a Phase IV Foundation Investigation report. However, if a signal pole has mast arm length exceeding 55 feet (16.7 m), then a foundation investigation report may be needed.

Traffic sign structures are normally designed by the contractor and may require a Phase IV Foundation Investigation report.

In general, the Phase IV foundation Investigation report should contain the following sections:

250.01	Introduction
250.02	Field Exploration and Laboratory Testing
250.03	Surface Conditions
250.04	Subsurface Conditions
250.05	Conclusions and Recommendations
250.06	Appendices
250.07	Foundation Investigation Plat
250.08	References

Consultation with the structural engineer during the preparation of the Phase IV report can help to avoid unnecessary engineering effort.

An addendum to the Phase IV Foundation Investigation report may be needed for some projects. Certain recommendations cannot be made in the Phase IV report until the structure has been designed by the structure engineer. For example, a structure with footing that will be supported by a pile group may need an addendum to address the settlement of the pile group. During the preparation of the Phase IV report, the layout of the pile group is not known and therefore the footing settlement cannot be calculated.

250.01 Introduction. State the purpose and scope of the investigation. Include a description of the proposed structure; location, type, length, number of spans, height above streambed or existing ground, approximate abutment and pier loads, height of approach fills, height of retaining structures, and ground-slope behind retaining structures.

Existing structures and approaches should also be described, including their foundation support. Previous investigations and/or other phase reports for the project should be referenced.

250.02 Field Exploration and Laboratory Testing. This section is a record of what was done and the methods used. Descriptions of materials encountered should be included in subsequent sections. Where exploration and testing are extensive or require detailed description, the text can be placed in an appendix and referenced here.

250.02.01 Borings/Test Pits. Describe the number, location, and depth of exploratory borings or test pits. Describe the type of borings or excavations and exploration method or equipment (auger or rotary drill, casing advancer, backhoe, etc.). Note elevation datum used. Reference Investigation Plat, appended Boring Location, or Site Plan and/or boring and test pit logs. (Copies of boring and/or test pit logs should be appended.)

250.02.02 Field Tests. Describe the field tests and measurements performed during the foundation investigation such as Standard Penetration tests (SPT), solid point penetrometer, Dutch cone (CPT), vane shear, Rock Quality Designation (RQD), groundwater elevation determination, etc. Describe the number and types of soil or rock samples recovered. Make reference to the location in the report where field test results are summarized (usually on boring logs). If no field tests are performed, justification should be given.

250.02.03 Geophysical Exploration. Describe the type and extent of geophysical surveys, including location, number, and length of lines, and explosives, if used. Reference the location in the report where test locations and results are summarized.

250.02.04 Laboratory Tests. List the laboratory tests performed, type of material tested, and purpose of the tests. Summarize the laboratory test results in a table or other appropriate format. Reference appended test results or laboratory report number.

250.03 Surface Conditions. Describe the surface conditions at the site: topography, relief, vegetation, previous and/or existing construction, damage to existing facilities if present, ground surface conditions, surface drainage or lack thereof, etc. Predicted scour depth and stream velocity data (that are normally available from the hydraulic report) should be presented here. Reference sources of information if from previous reports, plans, etc. Reference specific elevations to a datum, i.e., USC&GS, NOAA, or local assigned benchmark elevation.

Be sure local assigned benchmark elevations are referenced to the appropriate USC&GS or NOAA datum. The location of a local assigned benchmark and the nearest appropriate datum benchmark should be described and shown on the Investigation Plat.

250.04 Subsurface Conditions. Describe the subsurface profile, including soil or rock classification, physical properties, strength, compressibility, thickness, continuity, depth-to-rock or rock-like material, groundwater levels, and other conditions such as animal burrows, subsurface structures, frost susceptibility, frost depth, etc., which may have a bearing on the recommendations for foundation design.

250.05 Conclusions and Recommendations. Geotechnical recommendations and design criteria needed for designing the structure foundation should be provided in the following format. Include the basis or justification for recommendations. Use drawings to illustrate recommendations when appropriate.

250.05.01 General. Make general conclusions regarding suitability of foundation types analyzed and recommended.

250.05.02 Foundations. Recommendations and design criteria for foundation support should include the following. Where more than one foundation system is appropriate or feasible, recommendations should be provided for each alternate.

250.05.02.01 Spread Footings.

A. Allowable Stress Design: If the structure foundation will be designed using Allowable Stress Design (ASD) method, the following information should be provided:

Recommended minimum footing width, depth of embedment, and footing elevation. Setbacks and/or minimum embedments should be presented for footings in embankments or footing near slope.

Allowable footing bearing capacity under static and dynamic load. Include graphs showing bearing capacity versus footing size. Provide coefficient of subgrade reaction k for mat footings.

Coefficient of base friction and, where appropriate, passive resistance against footing edges.

Treatment of supporting stratum, i.e., overexcavation, backfill, compaction, etc.

In case where overall stability of the footing may govern the design, such as a footing on or adjacent to slope, provide global stability analysis of the footing.

Estimated settlement and time for settlement to complete.

For traffic signal poles or sign structures, spread footings are sometimes used instead of typical caissons. The soil strengths resisting lateral movement, overturning and rotation of foundations are very critical. Therefore, additional information on strength of soil around the footing, such as equivalent fluid pressures, coefficient of lateral sub-grade reaction, adhesion of cohesive soils, etc., must be provided.

B. Load and Resistance Factor Design: If the structure foundation will be designed using Load and Resistance Factor Design (LRFD) method, the following information should be provided:

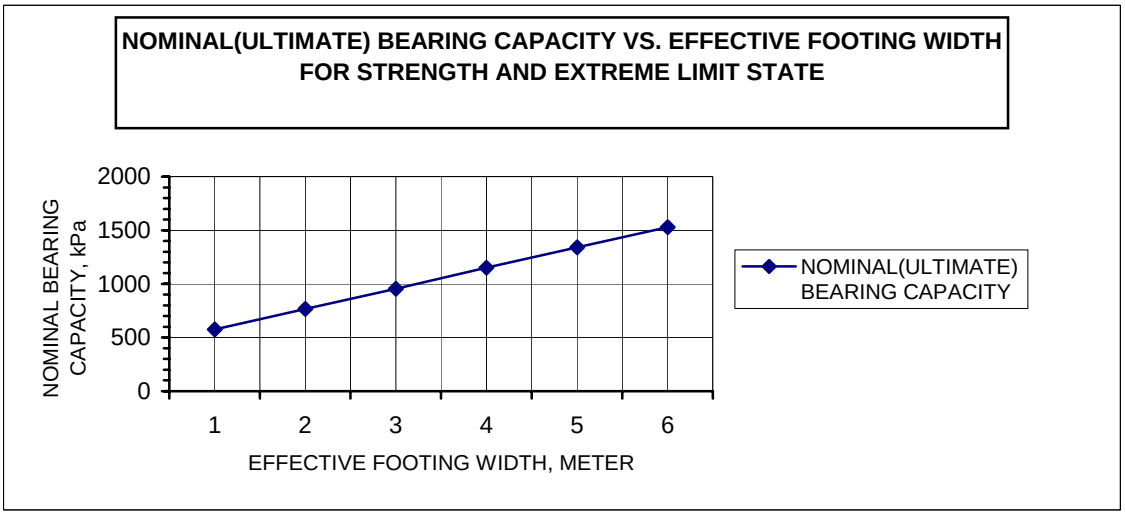
Recommended minimum footing width, depth of embedment and footing elevation. Setbacks and/or minimum embedment should be presented for footings in embankments or footing near slope.

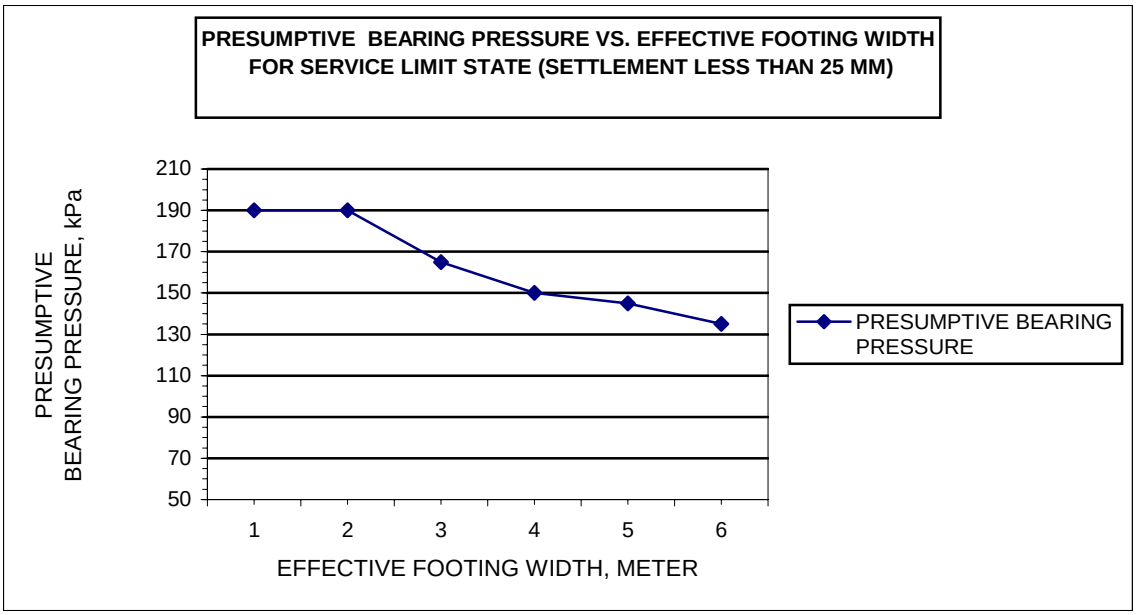
Engineering properties of foundation soil or rock, such as cohesion, friction angle, etc. and method used to determine those properties, such as lab tests, estimating from SPT data, etc. Provide recommended resistance factors for soil or rock at the Strength Limit state based on knowledge of and experience with the involved materials.

Include a graph showing the relationship between the nominal (ultimate, unfactored) bearing capacity and the effective footing width for Extreme and Strength Limit state. Report method(s) used to determine the bearing capacities shown in this graph.

Include a graph showing the relationship between the presumptive bearing pressure and the effective footing width for Service Limit state. Service limit state for spread footings is normally governed by footing settlement. For cohesionless soils, settlement plots are typically based on estimated settlement of 1 inch (25 mm). However, a family of curves for different magnitudes of settlement would be more useful in some cases. Report method(s) used to determine the presumptive bearing pressures shown in these graphs.

Examples of the nominal bearing capacity and presumptive bearing pressure versus effective footing width are shown below.





250.05.02.02 Deep Foundations.

A. Allowable Stress Design: If the structure foundation will be designed using the Allowable Stress Design (ASD) method, provide the following information:

Type of deep foundation, such as piling or drilled shaft. Pile type(s), size(s), tip protection if needed. Drilled shaft diameter(s). (Recommend only one type or size of pile or drilled shaft unless it is necessary to recommend several different types or sizes. Discuss with the structural engineer before making the recommendation).

Pile or drilled shaft length, embedment, and tip elevation. Indicate minimum spacing for piles or drilled shafts and supporting stratum.

Allowable vertical load (how estimated), negative friction, and uplift resistance if applicable.

Estimated settlement of pile group (if available) and time for settlement to complete.

Allowable lateral load and point of application in each direction of the principal axes of the pile, estimated point-of-fixity of pile or drilled shaft. Graph showing relationship of pile (or shaft) deflection and allowable lateral load. A series of graph showing pile (or shaft) top deflection from approximate 0.25” (6 mm) to 2” (50 mm) in increment of .25” (6 mm) of deflection should be provided (for no scour and scour condition, if scour is expected). Graph showing relationship between lateral loads and moments induced in piles should be provided if available.

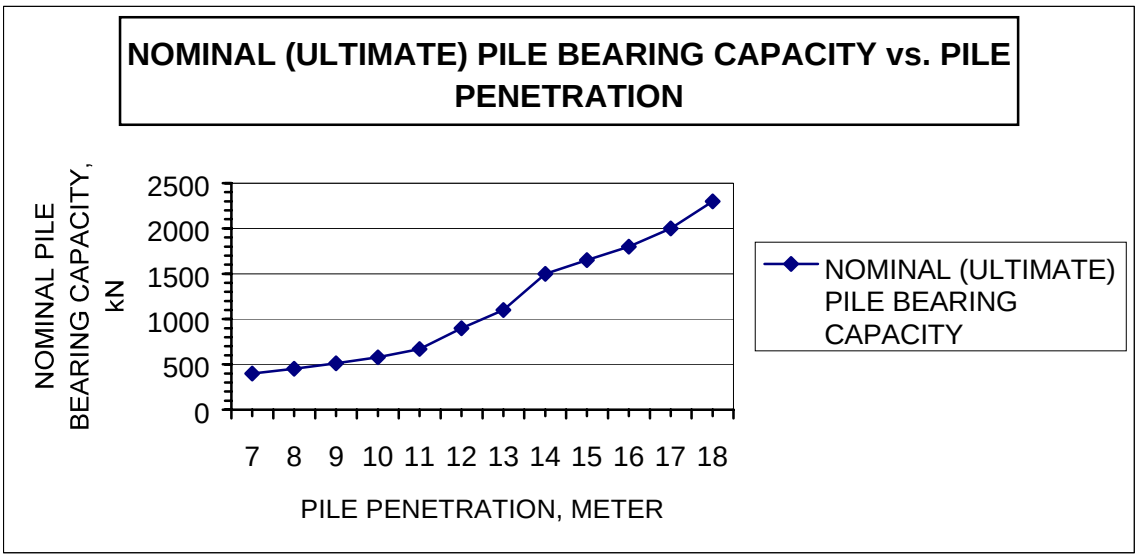
Include recommendations for highest permissible tip elevation or minimum penetration, if applicable. Determine pre-drilling needs, diameter and depth of pre-drilled hole, backfill material, and state purpose of pre-drilling.

Translational stiffness coefficient, for all three dimensions, may have to be provided for seismic design of the pile foundation.

B. Load and Resistance Factor Design: If the structure foundation will be designed using Load and Resistance Factor Design (LRFD) method, the following information should be provided:

Engineering properties of foundation soil or rock, such as cohesion, friction angle, etc. and method used to determine those properties, such as lab tests, estimating from SPT data, etc. Provide recommended resistance factors for soils or rock at Strength limit state based on knowledge and experience of the involved materials.

Graph showing the relationship between nominal (ultimate, unfactored) pile (or drilled shaft) bearing capacity and pile (or drilled shaft) penetration for Extreme and Strength Limit states. List method(s) used to determine pile (or drilled shaft) bearing capacities shown in this graph. An example of this graph is shown below. If scour is expected, graph of pile capacity versus penetration for scour condition should also be provided.



Graphs showing the relationship between nominal (ultimate, unfactored) lateral loads and pile (or drilled shaft) deflections (and moments if available) and method used to develop these relationships, such as COM 624 or LPILE computer program (for each direction of the principal axes of pile). A series of graph showing pile (or shaft) top deflection from approximate 0.25” (6 mm) to 2” (50 mm) in increment of .25” (6 mm) of deflection should be provided (in no scour and scour condition, if scour is expected).

Settlement magnitude and rate of a single pile (or drilled shaft) and pile (or drilled shaft) group (if layout of pile or shaft group is known), which is caused by presumptive loads at Service limit state. Estimated down-drag load (negative friction) on pile or drilled shaft, and uplift resistance of pile or drilled shaft if applicable.

Translational stiffness coefficient, for all three dimensions, may have to be provided for seismic design of the pile foundation.

250.05.03 Lateral Pressures and Backfill. Provide recommendations for type and source of abutment or wall backfill, strength parameters, and recommended lateral earth pressures. For abutments, lateral pressures should include active, at-rest, and passive values accounting for the potential effects of hydrostatic pressures; traffic or other surcharge pressures; and pressure distributions as appropriate. In areas of high potential ground accelerations, dynamic pressures should be evaluated.

250.05.04 Anchors. On tied back wall projects or where foundation anchors will be needed, provide design criteria for anchors. Recommendations regarding bond zone length and bond stress should be carefully worded to include specific conditions assumed in analysis. Normally, these data are for ITD estimating purposes only and should be so noted. Free (un-bonded) length and corrosion protection criteria should be included.

This section may be deleted for projects without anchors.

250.05.05 Drainage. Provide recommendations for surface and subsurface drainage where required, and recommended drainage behind retaining walls, abutments and wing walls (pipes, drain blankets, weep holes, etc.). Include type and source of materials and gradations of protected soil if filters will be used.

Provide recommendations for abutment embankment foundation drainage where needed. These may include drain blankets, perforated pipe, vertical drains, etc.

250.05.06 Embankments. Provide recommended side slopes, embankment zonation and facing, compaction levels, foundation treatments, and estimated amount and rate of settlement. Where appropriate, provide recommendations for special items such as instrumentation, placement rates, waiting periods, and surcharge requirements.

Refer to drainage in previous sections when necessary. Refer to stability analyses methods and results or to discussion and results presented in an appendix. Seismic stability should be evaluated in areas of potentially high ground acceleration.

250.05.07 Erosion Control. Provide slope paving, riprap, and scour protection recommendations.

Include potential source for riprap along with the design stone size and layer thickness (available from hydraulic report), placement method, need for graded or cushion layer, and geotextile filter. Gradation, classification, and permeability estimates are needed for the filtered soil.

Recommendations for serrations, seeding, rock armor, etc. for slope protection.

250.05.08 Seismic Design. Provide a design peak, velocity-related, acceleration coefficient (10% probability of exceedence in 50 years) for the project location (see Figure 250.05.08.1). Include data on depth-to-bedrock or rock-like material. Provide estimate and/or analysis of liquefaction potential. Note other potential seismic hazards such as slope failure, flooding, fault rupture, and proximity to active or potentially active faults.

For bridges in seismic design categories B, C, and D (AASHTO Guide Specifications for Seismic Design of Highway Bridges), the Bridge Design Section may elect to make a dynamic analysis. Analysis of liquefaction potential or ground stability may require use of the dynamic ground response programs such as “SHAKE.”

Figure 250.05.08.2 shows effective peak firm ground (rock) accelerations. These values are more appropriate where base accelerations are needed for site-specific analyses of embankments or liquefaction.

Dynamic analyses require that additional soil parameters be included in the Phase IV report. A list of the soil parameters needed for dynamic analyses are shown on Figure 250.05.08.3.

Figure 250.05.08.1

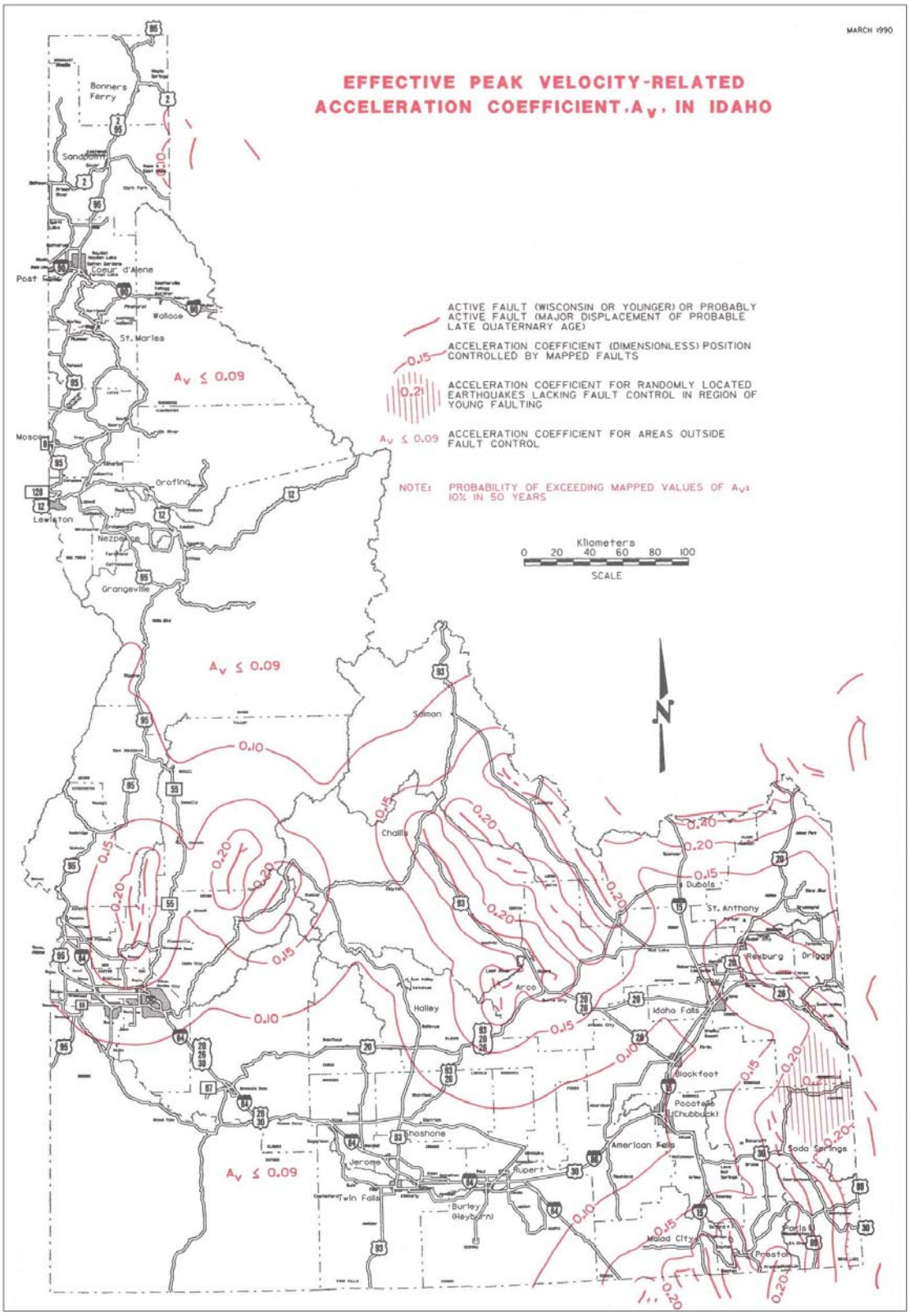


Figure 250.05.08.2

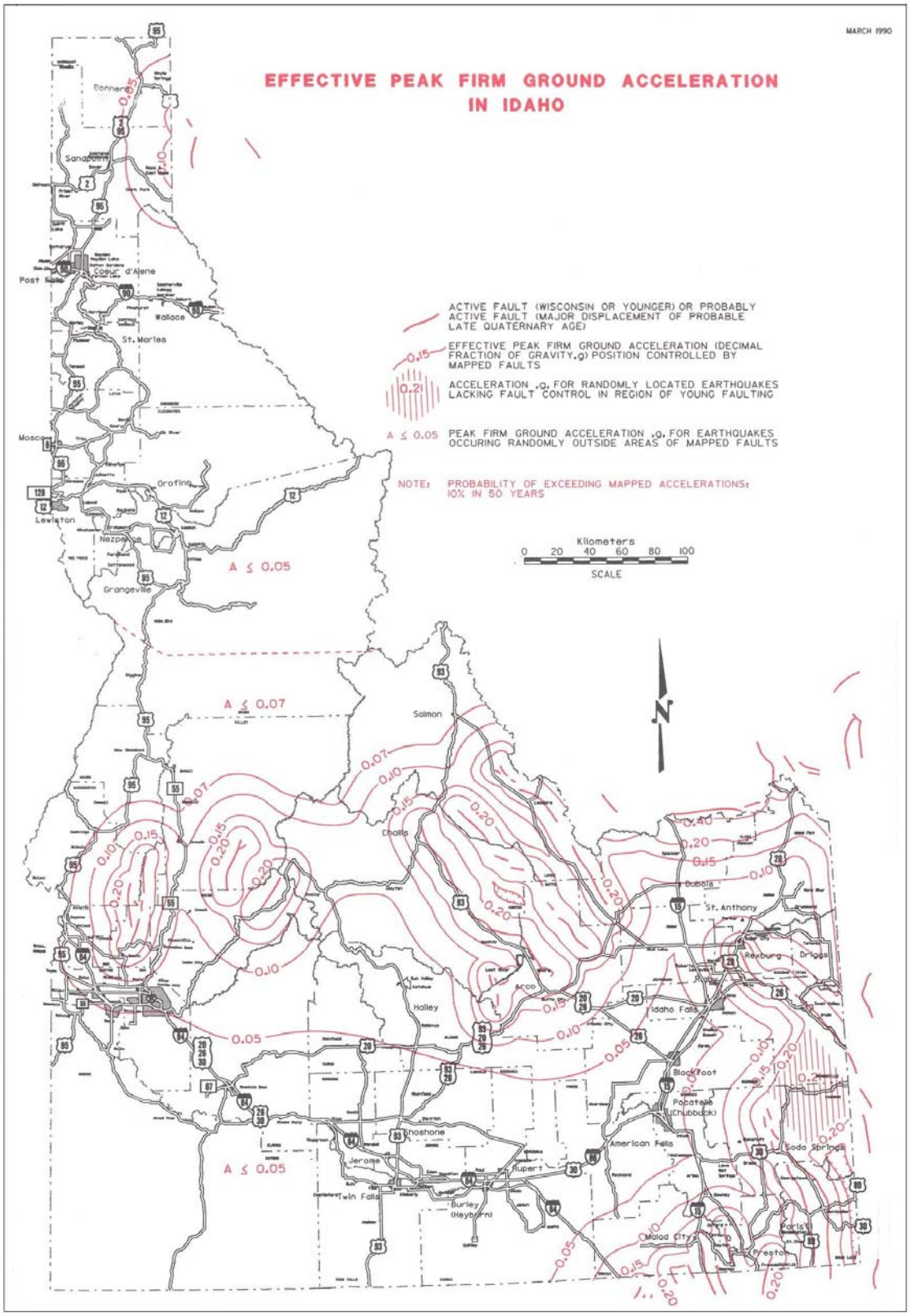


Figure 250.05.08.3

SOIL PARAMETERS

Foundation Type/Problem	Typical Soil Parameters Needed
Abutment Design	Friction Angle, φ Unit Weight, γ Young's Modulus, E_s
Footing Stiffness	Shear Modulus, G Poisson's Ratio, υ
Piles and Drilled Shafts	Friction Angle, φ Shear Strength, c Unit Weight, γ Strain at 50 % of the peak axial stress of unconfined compression test, ε_c
Ground Stability	Liquefaction Strength, τ/σ_y Unit Weight, γ Permeability, k Coefficient of Compressibility, m_υ Relative Density, D_r

250.05.09 Construction. Describe any unusual construction problems or requirements such as casing needs, sequence of embankment placement, equipment mobility, de-watering, temporary excavation support, seasonal construction, equipment size limitations, etc. For pile foundations include hammer energy limitations, zones of hard driving expected, obstructions such as boulders, redriving requirements, setup time, test piles, results of wave equation analysis, if performed during design, need of pre-drilling for piles, etc.

Recommend Pile Dynamic Analyzer (PDA) test when needed and number of piles to be tested. Recommend non-destructive tests for drilled shaft, such as Crosshole Sonic Logging or Gamma-Gamma testing, if needed.

250.06 Appendices. When needed to supplement recommendations, include bearing capacity curves and illustrations for wall backfill, drainage, lateral pressures, embankment zonation, instrumentation details, etc. A reduced print of the Investigation Plat should be included. Consultant reports must include a Site or Boring Location Plan.

Appended material should also include boring logs, geophysical results, and laboratory test results or ITD lab number. A detailed description of the exploration and testing program may precede the field and lab data, if the text is not included in Section 250.02.

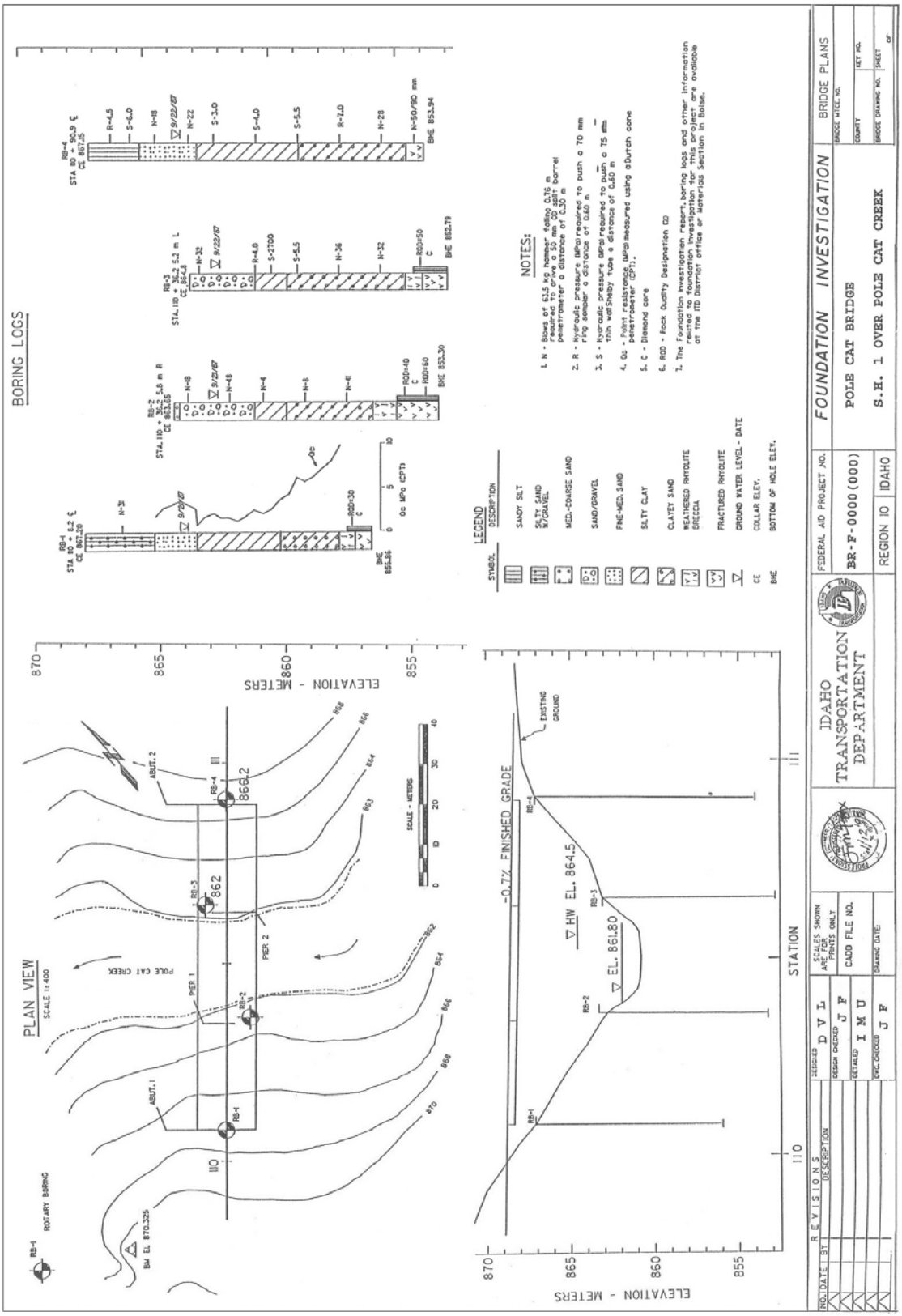
A separate appendix should be prepared to include discussion and analysis relating to large embankments, high cuts, unusual or heavily loaded foundations, stability problems, or soft foundation problems. This discussion is intended to document and support the conclusions and recommendations.

Calculations, such as calculations of footing bearing capacity, embankment settlement, slope stability, etc. should be included in the Appendix.

250.07 Foundation Investigation Plat. The Foundation Investigation Plat should be prepared in accordance with the format example in Figure 250.08.1. (Note that for a bridge, the title block of the plat is that for a bridge plan, not a roadway plan). Plats shall be prepared on standard 22” × 36” (560 mm × 915 mm) mylar sheets. The original mylar and five prints on white paper at plan size 11” × 17” (280 mm × 432 mm) shall be sent to the Materials Section. The Materials Section will send the full size mylar, reproducible to the Bridge Design Section. Prints will be distributed to Roadway Design, Materials, District Project Development, District Materials, and FHWA.

For buildings and traffic signal poles or sign structures, a plat on full size mylar sheet is not needed and only five copies of the Foundation Investigation plat on white paper in plan size will be required.

Figure 250.08.1



Basic plan controls, lettering, etc., shall be in accordance with Section 700 of the Design Manual. The scales are left to the individual preparing the plat, but should be large enough to properly illustrate the information when reduced 50 percent. Since plats will be published at 1/2 size, scales should be noted as applying to full size drawings. A bar or graphic scale should be included on the plan view. Where elevations and stationing are shown on the profile and elevations are shown on the graphic logs, scales may not be needed on these views.

The following note should always be included in the plat: “The Foundation Investigation Report, boring logs, and other information related to foundation investigation for this project are available at the ITD District Office or Materials Section in Boise.”

The final plat must be sealed and signed by the Professional Engineer or Geologist who is registered in Idaho and was responsible for the work.

250.08 References. The following is a partial list of foundation design references available in the District or Headquarters Materials Sections. References cited in the Phase IV report should be listed in a references section following Section 250.05.

- AASHTO Standard Specifications For Highway Bridges
- NAVFAC DM-7
- FHWA Soils and Foundations Workshop Manual
- FHWA Manual on Design and Construction of Driven Pile Foundations
- FHWA Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications
- “Foundation Engineering” Peck, Hanson & Thornburn
- “Foundation Engineering Handbook,” Winterkorn and Fang
- “Principal Of Geotechnical Engineering” B. M. Das
- “Earthquake Engineering,” Wiegel
- “Soil Mechanics” Lambe & Whitman
- “Foundation Analysis and Design,” Joseph E. Bowles
- “Foundations On Rock” D.C Wyllie
- “Basic Soil Engineering,” B. K. Hough
- “Foundation Design,” Teng
- “Geotechnical and Foundation Engineering”, Robert W. Day
- “Pile Foundation Analyses and Design,” Poulos and Davis
- “Lateral Stresses in the Ground and Design of Earth Retaining Structures,” ASCE, 1970 Speciality Conference
- FHWA Geotechnical Instrumentation Manual
- NHI Geotextile Engineering Manual
- “Drilled Shafts: Construction Procedures and Design Methods” FHWA Publication #FHWA-IF-99-025